

METHOD TO ACHIEVE LOW AND STABLE FERROMAGNETIC COUPLING FIELD

ABSTRACT OF THE DISCLOSURE

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A method for making spin valves with low and stable coupling field includes the oxygen exposure steps. In this method, a first ferromagnetic layer is deposited onto a substrate using an ion beam sputtering process. The first surface of the first ferromagnetic layer is exposed to an oxygen-rich atmosphere with oxygen partial pressure of about 5×10^{-6} Torr. Oxygen is physisorbed on the first surface. The oxygen partial pressure rapidly decreases to below 10^{-8} Torr levels before a spacer layer of about 20Å thick copper is deposited onto the first oxygen treated surface. The spacer layer has a second surface, which is treated with oxygen with a process similar to the process for treating the first surface. The oxygen partial pressure rapidly decreases to below 10^{-8} Torr levels before a second ferromagnetic layer is deposited onto the second oxygen treated surface. Surface adsorption of oxygen limits the intermixing between the layers and reduces the surface roughness of these surfaces, which results in reducing the coupling field of the spin valves. The coupling field is extremely stable upon hard bake anneal. The magnetoresistive ratio also is significantly enhanced. This method can be applied for top and bottom simple spin valves, top and bottom AP-pinned spin valves, and dual spin valves.